

CLAIMS

1. A force feedback apparatus comprising:  
jetting means that includes a nozzle and  
5 that can control a jet amount or a jet direction of  
gas or liquid jetted from the nozzle;  
jet control means for controlling the jet  
amount or the jet direction of the gas or the liquid  
according to a position or an orientation of a  
10 receiver that receives a pressure by the gas or the  
liquid jetted from the jetting means so as to  
provide force feedback to an operator, wherein the  
position or the orientation of the receiver is  
measured by receiver measurement means;  
15 wherein, when the receiver has a concave  
shape of a diameter D, intervals for placing the  
nozzles in the jetting means are set such that at  
least one nozzle exists within a region having a  
diameter of a constant  $\times$  D.  
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2. The force feedback apparatus as claimed  
25 in claim 1, wherein the receiver has a hemispheric  
shape and the constant is 0.8.

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3. A force feedback apparatus comprising:  
jetting means that includes a nozzle and  
that can control a jet amount or a jet direction of  
gas or liquid jetted from the nozzle;  
35 jet control means for controlling the jet  
amount or the jet direction of the gas or the liquid  
according to a position or an orientation of a

receiver that receives a pressure by the gas or the liquid jetted from the jetting means so as to provide force feedback to an operator, wherein the position or the orientation of the receiver is  
5 measured by receiver measurement means;

wherein the nozzle includes nozzle open/close means for opening or closing in response to occurrence of a jet of the gas or the liquid, and wherein a point of support for opening and closing  
10 of the nozzle open/close means is provided on the side of the operator.

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4. The force feedback apparatus as claimed in claim 1, wherein the nozzle includes nozzle open/close means for opening or closing in response to occurrence of a jet of the gas or the liquid, and  
20 wherein a point of support for opening and closing of the nozzle open/close means is provided on the side of the operator.

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5. The force feedback apparatus as claimed in claim 1 or 3, further comprising virtual object calculation means for calculating a state of a  
30 virtual object in a virtual environment, to be displayed by virtual environment display means, according to the position or the orientation of the receiver.

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6. The force feedback apparatus as claimed in claim 5, further comprising sound generation control means for controlling an attribute of a sound, to be generated by sound generation means, according to the state of the virtual object, or the position or the orientation of the receiver.

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7. The force feedback apparatus as claimed in claim 6, wherein the sound generation control means controls the attribute of the sound, to be generated by the sound generation means, according to the state of the virtual object, or the position or the orientation of the receiver, and according to identification of the receiver or a shape or a color of the receiver measured by the receiver measurement means.

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8. A force feedback method comprising a step of controlling a jet amount or a jet direction of gas or liquid according to a position or an orientation of a receiver that receives a pressure by the gas or the liquid jetted from a nozzle so as to provide force feedback to an operator,

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wherein, when the receiver has a concave shape of a diameter  $D$ , intervals for placing the nozzles in jetting means are set such that at least one nozzle exists within a region having a diameter of a constant  $\times D$ .

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9. The force feedback method as claimed in claim 8, wherein the receiver has a hemispheric shape and the constant is 0.8.

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10. The force feedback method as claimed in claim 8, further comprising a virtual object calculation step of calculating a state of a virtual object in a virtual environment, to be displayed by virtual environment display means, according to the position or the orientation of the receiver.

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11. The force feedback method as claimed in claim 10, further comprising a sound generation control step of controlling an attribute of a sound, to be generated by sound generation means, according to the state of the virtual object, or the position or the orientation of the receiver.

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12. The force feedback method as claimed in claim 11, the sound generation control step including a step of controlling the attribute of the sound, to be generated by the sound generation means, according to the state of the virtual object, or the position or the orientation of the receiver, and according to identification of the receiver or a shape or a color of the receiver.

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13. A force feedback program for causing a  
5 computer to function as:

virtual object calculation means for  
calculating a state of a virtual object in a virtual  
environment, to be displayed by virtual environment  
display means, according to a position or an  
10 orientation of a receiver that receives a pressure  
by gas or liquid jetted from a nozzle, wherein the  
position or the orientation of the receiver is  
measured by receiver measurement means;

jet control means for controlling a jet  
15 amount or a jet direction of the gas or the liquid  
according to the state of the virtual object, or the  
position or the orientation of the receiver; and

sound generation control means for  
controlling an attribute of a sound, to be generated  
20 by sound generation means, according to the state of  
the virtual object, or the position or the  
orientation of the receiver.

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14. The force feedback program as claimed  
in claim 13, wherein the sound generation control  
means controls the attribute of the sound, to be  
30 generated by the sound generation means, according  
to the state of the virtual object, or the position  
or the orientation of the receiver, and according to  
identification of the receiver or a shape or a color  
of the receiver measured by the receiver measurement  
35 means.